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(71) Applicant *(for all designated States except US)*: **THE PROCTER & GAMBLE COMPANY** [US/US]; One Procter & Gamble Plaza, Cincinnati, OH 45202 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **WOOLSTON, Robert** [GB/GB]; 3 Chestnut Grove, Moreton Morrell, Warwick CV15 9DG (GB). **DAY, Shane, Alistair** [GB/GB]; 4 Brese Avenue, Warwick CV34 5TS (GB). **QUAN, Ke, Ming** [GB/US]; 8647 Eagle Ridge Drive, West Chester, OH 45069 (US). **STEPHENS, Tracy** [GB/GB]; 2 Bartholomew Place, Warfield, Berkshire RG42 3DQ (GB). **JACOBS, Linda, Helen** [GB/GB]; 24 Strouds Meadow, Cold Ash, Thatcham, Berkshire RG18 9PQ (GB).

(74) Common Representative: **THE PROCTER & GAMBLE COMPANY**; c/o Mr. T. David Reed, 5299 Spring Grove Avenue, Cincinnati, OH 45217 (US).

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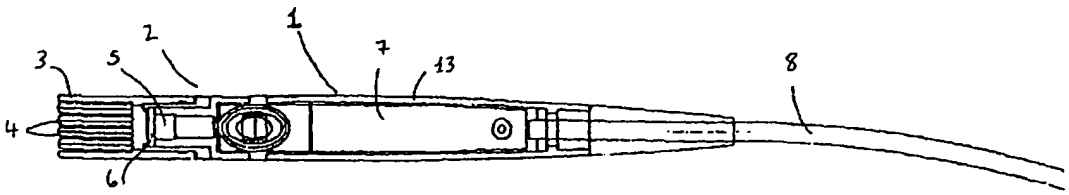
(54) Title: METHOD, APPARATUS AND SYSTEM FOR ASSESSING HAIR CONDITION



(57) Abstract: Method for measuring friction in a hair sample, comprising: (a) providing a friction member; (b) drawing it through the hair, generating a frictional noise signal; and (c) capturing the signal by a noise sensor. Device suitable for use in said method, comprising comb means having a plurality of tines and a noise sensor arranged to capture frictional noise generated by passage of comb means through the hair. System for assessing the level of damage in a hair sample, comprising: (a) defining hair categories; (b) associating with each category a standard trace representative of the frictional noise signal generated when a standard sample in that category is subjected to said method; (c) assigning the sample to one of the categories; (d) carrying out said method on the sample; (e) visually displaying the frictional noise signal generated as a trace; (f) and comparing the sample's trace with the standard trace associated with the category.

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METHOD, APPARATUS AND SYSTEM FOR ASSESSING HAIR CONDITION

TECHNICAL FIELD

This invention relates to an apparatus, a method and a system for assessing the condition of hair, in particular assessing the degree of damage in the hair.

BACKGROUND

In the hair care field it is often important to assess the condition of a consumer's hair. In particular it is often valuable to be able to assess the degree of damage sustained by the hair. It is known that the surface of a hair fibre becomes rougher when the hair is subjected to damage, for instance as a result of brushing, bleaching, perming, colouring, etc. This reduction in smoothness is believed to result from changes in the structure of the cuticle, the outermost part of the hair fibre.

It is known to assess roughness, and by implication damage by measuring the degree of friction generated by subjecting the hair to certain conditions. For instance, ease of combing is commonly used as a measure of smoothness. In one combing test the force required to detangle, by drawing a comb through, a bundle of hair fibres is used to assess friction, roughness and damage.

EP-A-965,834 describes friction-measuring equipment for evaluating the effects of cosmetics on skin, hair, membranes and eyes. This equipment assesses friction by means of deformation of a deformable assembly on a probe.

JP 63/163143 measures the degree of damage to hair by comparing forward and reverse friction forces. These forces are measured by means of a torque meter.

JP 62/273433 measures friction between hairs by passing a fluid in turbulent flow over a bundle of hair and measuring friction by detecting pressure loss in the fluid.

It would be desirable to be able to provide systems that allow the convenient measurement and analysis of surface friction of hair. It would also be desirable to provide a means of relating this to levels of damage across a range of hair types.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be illustrated with reference to the Figures, which show the following.

Figure 1 is a top cross-sectional view of a preferred device according to the invention.

Figure 2 is an end view of the same device.

Figure 3 is a side cross-sectional view of the same device.

Figure 4 is an exploded view of the same device.

Figures 5 to 10 show example traces from six different categories of hair.

DETAILED DESCRIPTION OF THE INVENTION

A method

According to a first aspect of the invention we provide a method for measuring the friction generated by a bundle of hair fibres, comprising providing a friction member, drawing the friction member through the bundle of hair, whereby a frictional noise signal is generated, and capturing the frictional noise signal by a noise sensor. Generally the captured noise signal is converted to a form that can be displayed. The converted signal is then displayed using display means. Such means may include, but is not limited to display screens selected from the group consisting of a computer screen, a cathode ray tube device, and a liquid crystal display device.

In the invention the friction generated by a bundle of hair is measured. The hair may be that of any mammal, preferably human, dog, horse, or cat, more preferably human hair. The bundle of hair may be a hair sample or switch but is preferably hair growing on the head of a consumer.

In the method it is necessary to use both a friction member and a noise sensor. The friction member is drawn through the bundle of hair such that it contacts and passes over the surfaces of the individual hairs. This creates friction between the friction member and the hairs. We find that the frictional noise generated depends upon the level of friction between the friction member and the hair surfaces.

The friction member is generally formed from rigid material, preferably polymeric material. For instance it may be formed from high-density polyethylene (HDPE).

The friction member is preferably in the form of a comb means having a plurality, preferably at least three, and more preferably at least four tines. The comb means is usually drawn through the bundle of hair in the manner usual for a comb. This may be done the subject whose hair is being assessed or by another.

The frictional noise signal generated is captured by means of a frictional noise sensor, preferably a microphone. The microphone may for instance be a standard electronic microphone or a noise-cancelling microphone.

Once the frictional noise has been captured it can be displayed and analysed in any suitable manner. Preferably a visual display unit is also provided and the frictional noise sensed

by the sensor is converted to a signal that is then transferred to the visual display unit and displayed. It may for instance be displayed in the form of a trace of sound amplitude versus time. This conversion may be achieved using known means.

Preferably the display of the signal is substantially instantaneous, such that the frictional noise being generated by drawing the friction member through the bundle of hair is displayed at the same time as the friction member is being drawn through the bundle of hair.

In the method the frictional noise signal displayed may be obtained from a single pass of the friction member through the bundle of hair. Alternatively, the friction member may be drawn through the hair two or more times. Results may be accumulated or averaged.

While the inventive method provided herein may adequately be performed alone, it may further be performed in combination with other methods for assessing hair damage. Such additional methods to combined with the method herein may include, but are not limited to: intuitive self-assessment by the subject, visual or physical assessment by the subject or another, such as a beauty counselor, assessment using other devices which measures hair damage, chemical assessment of the hair, e.g. assessing the amount of broken versus unbroken disulfide bonds of cysteine in a subject's hair, and combinations thereof. Suitable hair damage measuring methods for use herein include, but are not limited to methods that employ devices that assess roughness, and by implication damage by measuring the degree of friction generated by subjecting the hair to certain conditions. For instance, ease of combing is commonly used as a measure of smoothness. In one combing test the force required to detangle, by drawing a comb through, a bundle of hair fibres is used to assess friction, roughness and damage.

A Device

The invention also provides, in a second aspect, a device suitable for use in the method of the first aspect. The device comprises a comb means having a plurality of tines and a frictional noise sensor. The device as a whole is preferably designed so that it is suitable for use in the hand. It is often elongate. The comb means is generally placed at one end of an elongate device.

Preferably the device is provided in at least two separable parts. In this case the first part comprises the comb means and the second part comprises a housing that contains the frictional noise sensor and, if required, means for converting the signal detected by the frictional noise sensor to a signal transferable to a visual display unit.

The noise sensor should be close to the comb means to achieve optimum sensitivity to frictional noise generated. However, generally it should not be in contact with the comb means. Thus protection means are generally provided between the noise sensor and the comb means to

prevent contact of the two components. This may be made from any material that is protective and acts to prevent contact between the comb means and noise sensor whilst allowing the passage of the frictional noise signal generated by contact of the comb means with hair.

For the purposes of detecting the frictional noise signal generated by comb means and hair we find that detection of frequencies in the range from about 50 Hz to about 5 kHz is preferred.

A device according the invention is exemplified in Figures 1 to 4. The device 1 is shown as elongate in shape. It has at its free end 2 a comb means 3 having tines 4. The comb may be formed from HDPE. The device 1 may be stored before and in between and after uses, e.g., on a magnetic stand.

The passage of the tines through a sample of hair generates frictional noise that is detected by the microphone 5. Between the microphone 5 and the comb is protective means 6 formed from foam, preferably open celled foam. The microphone 5 is connected to a circuit board 7, which converts the frictional noise generated to an electrical signal that passes along the cable 8 to means (not shown) for converting the signal into a visual display. For ease of use, the cable 8 may be situated as retractable.

The device 1 is constructed such that the microphone 5 detects signals at all times. The switch 9 can be switched by pressing the switch cover 10 to indicate that display and/or recording of the frictional noise signal should occur. The recording is indicated by an "on/off" LED, whose signal is visible from the exterior by means of the light pipe 12.

The microphone and circuit board are contained in a protective housing 13 that is removeably connected with the comb 3. The comb 3 may be removed for instance by twisting. This has the advantage that the comb may be removed for cleaning and replaced with a new comb.

Although it is known that there is a relationship between friction generated by combing hair and damage to that hair we have found that this is not the only significant factor when frictional noise is, as in the invention, used to assess friction levels. Frictional noise generation gives an accurate indication of friction levels but we have found that it is important to determine the characteristics of the hair being tested in order to assess whether the increased friction is due to damage and/or a rough hair surface or to other factors (for example hair curliness). We have found that this allows any particular hair sample (e.g. the hair of an individual consumer) to be analysed accurately for the level of damage in that particular hair sample. In the invention, varying friction and damage levels within a single sample may be observed by means of changes in amplitude as the comb means is passed through the sample.

A System

Thus according to a third aspect of the invention we provide a system for assessing the level of damage in a test sample of hair, comprising

defining a predetermined number of hair categories H,

associating with each hair category H a standard trace T representative of the frictional noise signal generated when a standard sample in that hair category is subjected to the method described above,

assigning the test hair sample to one of the predetermined categories Ht,

carrying out the method described above on the sample of hair,

visually displaying the frictional noise signal generated as a trace on a screen,

and comparing the sample's trace Tt with the standard trace T associated with the category Ht.

In this system it is necessary to define a number of predetermined categories of hair. These categories are defined by their tendency to give friction. For instance, in one system, three categories: high friction, moderate friction and low friction could be predetermined.

Hair of various types is then assigned to one of these predetermined categories according to relevant factors. These factors may be selected from ethnic origin (for instance if the hair is of European, Asian or African origin); waviness (whether the hair is straight, wavy or curly); whether the hair has been previously subjected to treatments (perming, bleaching or colouring). Thus this aspect of the invention is based at least in part on the realisation that frictional noise levels depend not only upon damage levels but on other hair characteristics.

With each category is associated a standard trace. This trace is an illustration of the frictional noise expected to be generated by a sample of hair in the defined category when subjected to the method described above.

In the system of the invention the hair sample to be tested, which may be a hair switch but is generally hair growing on the head of a consumer, is assigned to one of the predefined categories according to the factors discussed above.

The process of the invention is then carried out on the sample to be tested, generally in substantially the same manner as carried out to generate the standard traces above. The frictional noise signal generated is displayed as a trace on a screen and this sample trace is compared with the standard trace. It can then be assessed whether the hair sample is more or less damaged than would be expected from the characteristics above.

A significant factor is the amplitude of the frictional noise generated. In particular, when

the trace is presented as a graph of the relationship between amplitude and time then the area under the curve is generally proportional to the level of friction.

Thus this system has the advantage that the level of damage in any particular hair sample can be accurately assessed whilst taking into account the level of friction to be expected as a result of its characteristics. For instance, virgin (untreated) straight hair naturally gives a lower level of frictional noise than virgin curly hair. Thus in order to assess the necessity for use of treatment products on the hair it is important to predetermine the natural level of frictional noise which would be expected for hair of the relevant category.

For example, the hair categories illustrated in Figures 5 to 10 may be used as the predefined categories and the traces used as the standard traces in a method according to the invention. Figure 5 shows a standard trace for grey permed European hair. Figure 6 shows a standard trace for brown curly European hair. Figure 7 shows a standard trace for brown Asian hair. Figure 8 shows a standard trace for grey hair. Figure 9 shows a standard trace for brown permed and bleached European hair. Figure 10 shows a standard trace for brown virgin European hair. The level of friction decreases from Figure 5 to Figure 10. This is proportional to the area under the trace and, generally, the amplitude of the trace.

The system can be used by the consumer directly but is preferably applied by an operative or adviser, for instance in a store or salon. It is contemplated that after the assessment has been made appropriate treatment for the hair may further be proposed.

WHAT IS CLAIMED IS:

1. A method for measuring friction in a bundle of hair, characterized in that it comprises:

(1) providing a friction member;

(2) drawing the friction member through the bundle of hair, whereby a frictional noise signal is generated;

(3) capturing the frictional noise signal by a noise sensor.

2. A method according to claim 1, wherein the bundle of hair is that of a mammalian subject; preferably wherein the bundle of hair is that of a subject selected the group consisting of a human, a dog, a horse, and a cat; more preferably wherein the bundle of hair is that of a human subject.

3. A method according to any preceding claim, further comprising visually displaying the frictional noise signal via display means; preferably wherein the display means is selected from the group consisting of a computer screen, a cathode ray tube device, and a liquid crystal display device.

4. A method according to claim 3 in which the frictional noise signal is displayed in the form of a trace showing variation of sound amplitude with time.

5. A method according to any of claims 3 to 4, wherein capturing the frictional noise signal by a noise sensor and visually displaying of the frictional noise signal occur simultaneously.

6. A method according to any preceding claim further comprising using the generated frictional noise signal to assess degree of damage of the hair.

7. A method according to any preceding claim, wherein the frictional noise sensor detects sound in the frequency range 50 Hz to 5 kHz.

8. A device suitable for use in the method of any of claims 1 to 7, comprising a friction member which is a comb means having a plurality, preferably three, more preferably four, tines and a frictional noise sensor arranged to capture frictional noise generated by passage of the comb means through a bundle of hair.

9. A device according to claim 8 in which the tines are formed from rigid polymeric material, preferably high-density polyethylene.

10. A device according to any of claims 8 to 9, which is formed from two portions that are removably attached, the first portion comprising the comb means and the second portion containing the frictional noise sensor.

11. A device according to any of claims 8 to 10 comprising protection means, positioned between the comb means and the frictional noise sensor, for preventing contact between the comb means and the frictional noise sensor; preferably wherein said protection means is formed from foam.

12. A device according to any of claims 8 to 11, wherein the frictional noise sensor is a microphone.

13. A system for assessing the level of damage in a test sample of hair, comprising

defining a predetermined number of hair categories H,

associating with each hair category H a standard trace T representative of the frictional noise signal generated when a standard sample in that hair category is subjected to the method of any of claims 1 to 7,

assigning the test hair sample to one of the predetermined categories Ht,

carrying out the method of any of claims 1 to 7 on the test sample of hair,

visually displaying the frictional noise signal generated as a trace on a display screen,

and comparing the sample's trace Tt with the standard trace T associated with the category Ht.

14. A system according to claim 13 which comprises defining at least three different predetermined categories H each associated with a different trace T.

15. A system according to any of claims 13 to 14, wherein the assignment of the test hair sample to one of the predetermined categories is carried out by taking into account any one or more of the following factors: ethnic origin, waviness and past hair treatments.

16. A system according to any of claims 13 to 15 in which the test hair sample is hair growing on the head of the subject.

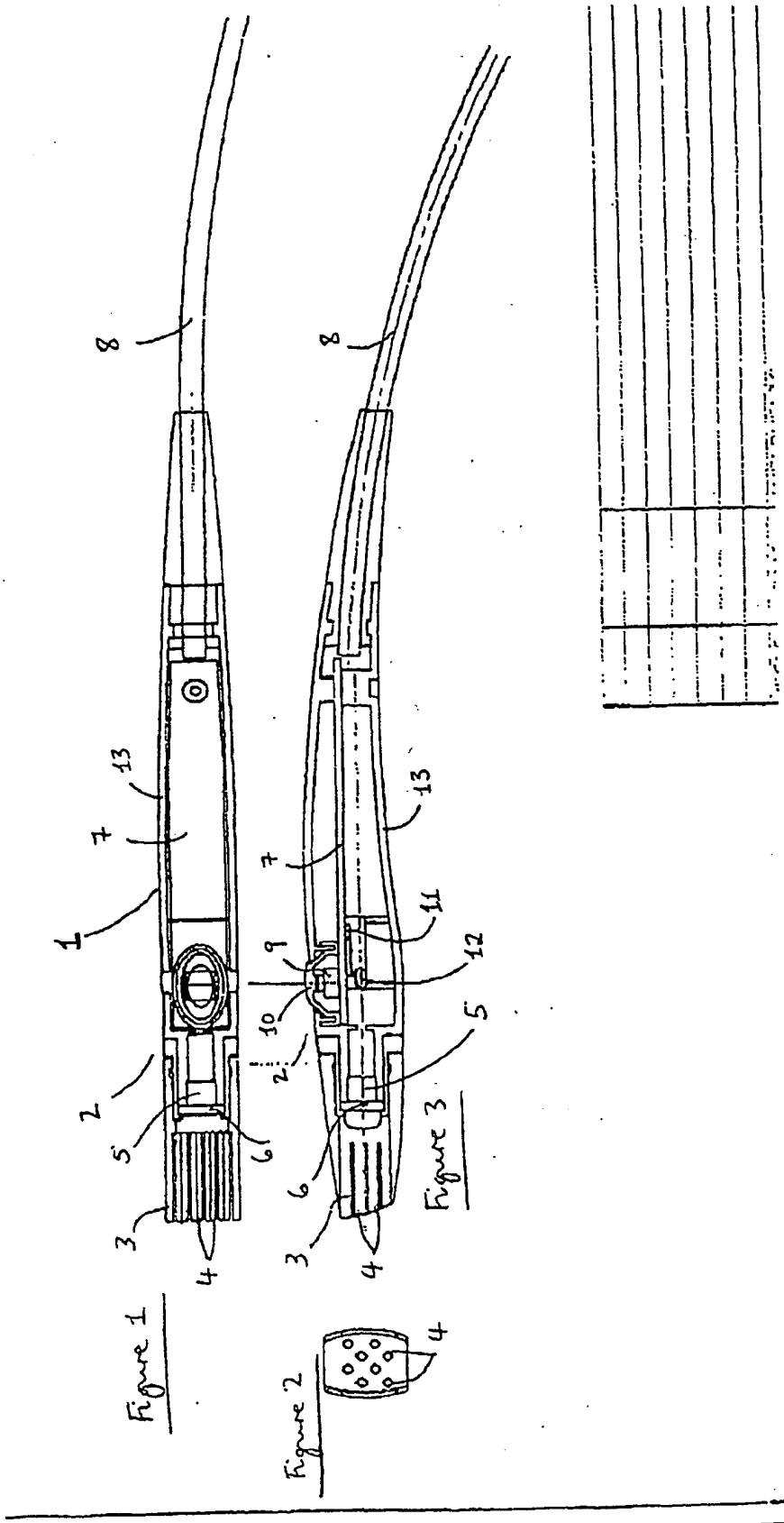
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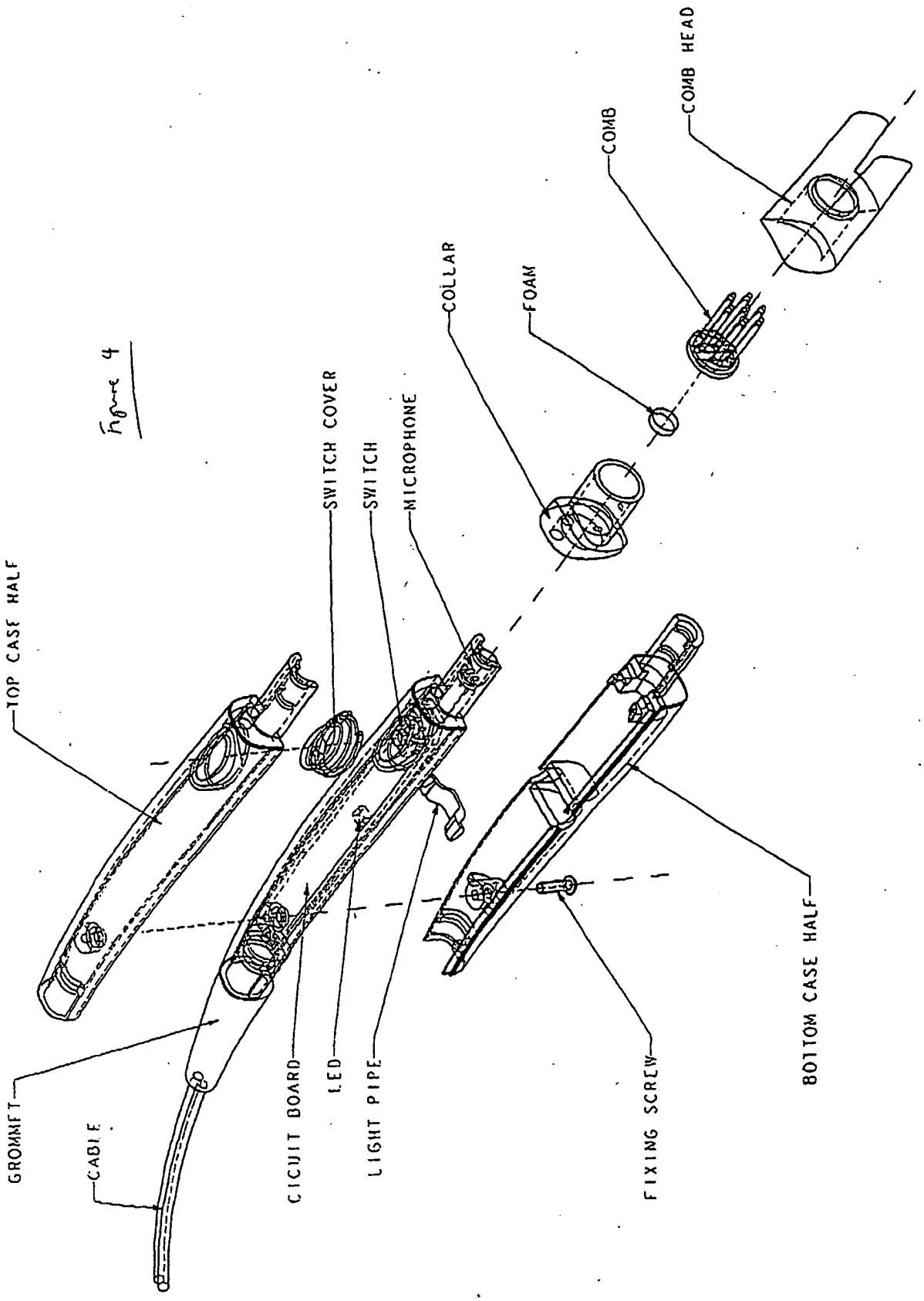
Figure 1
Figure 2
Figure 3

Figure 4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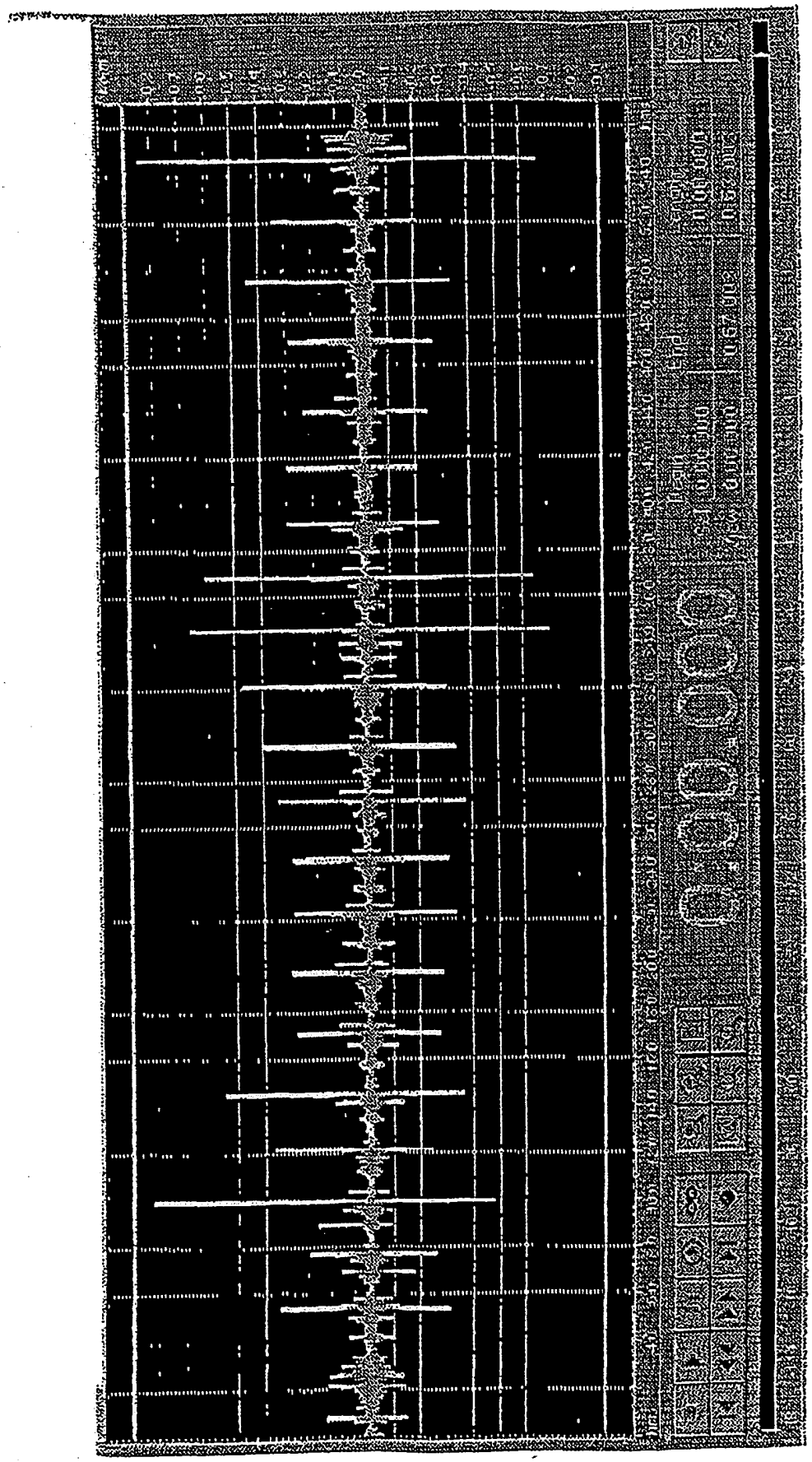

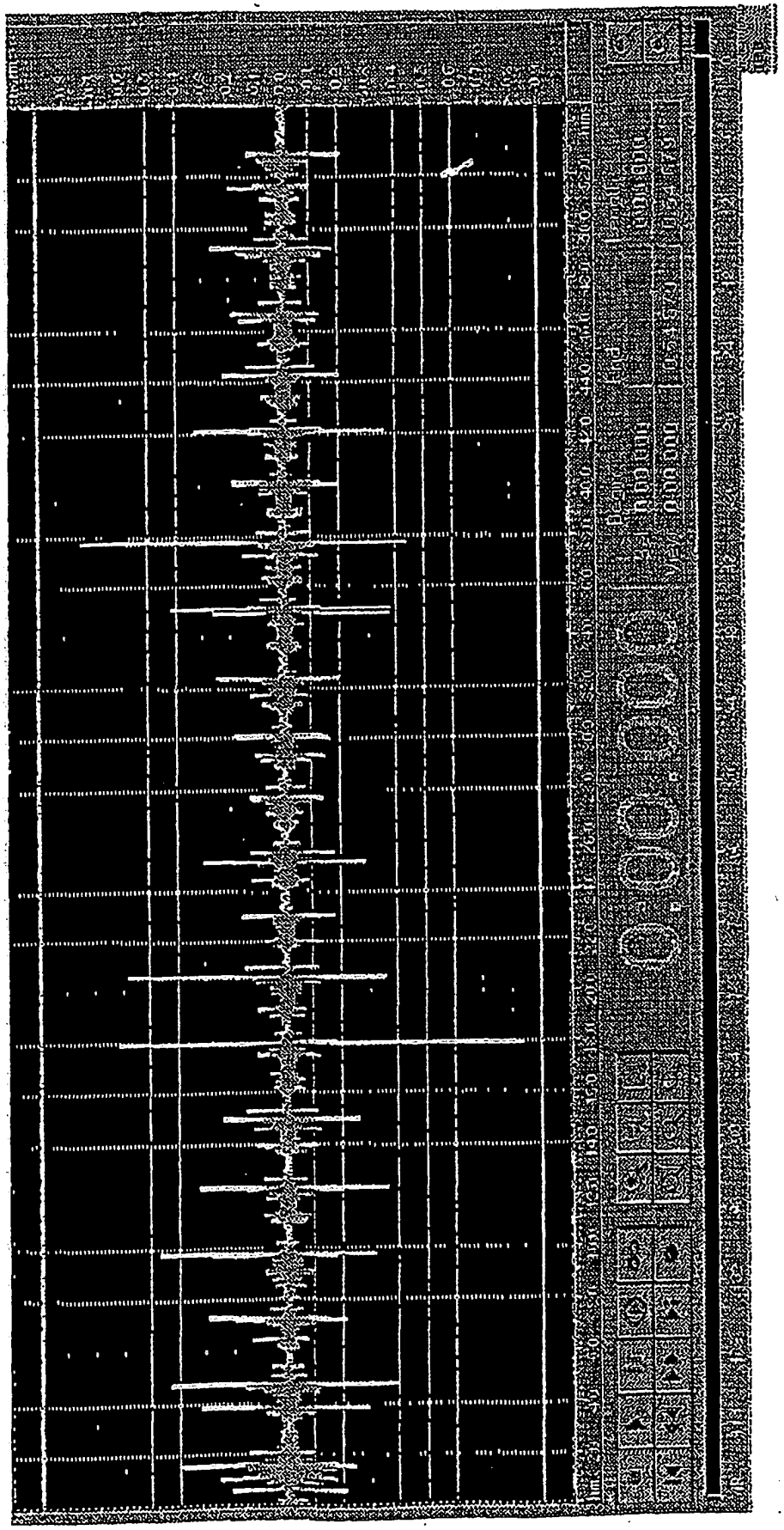

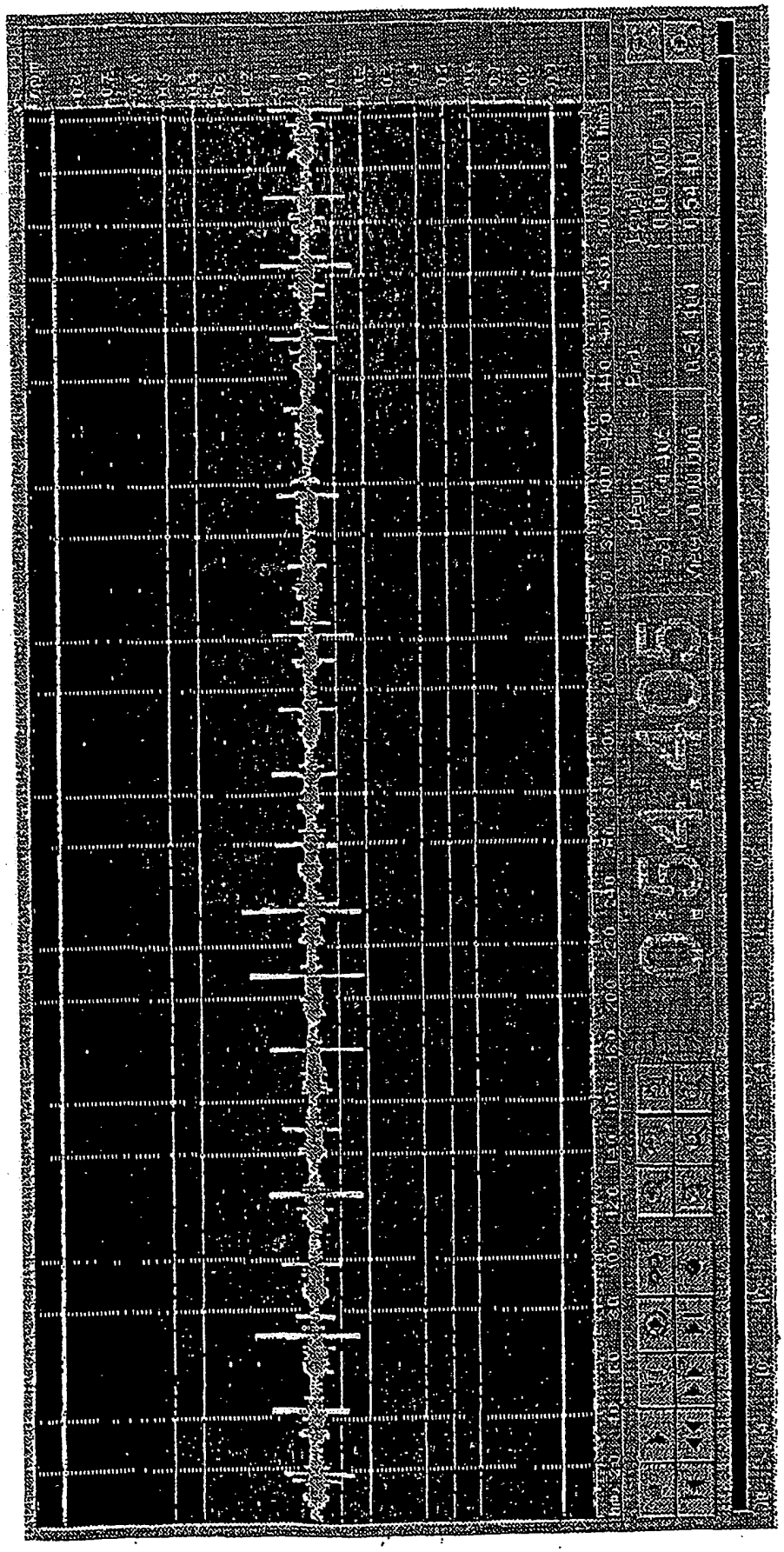

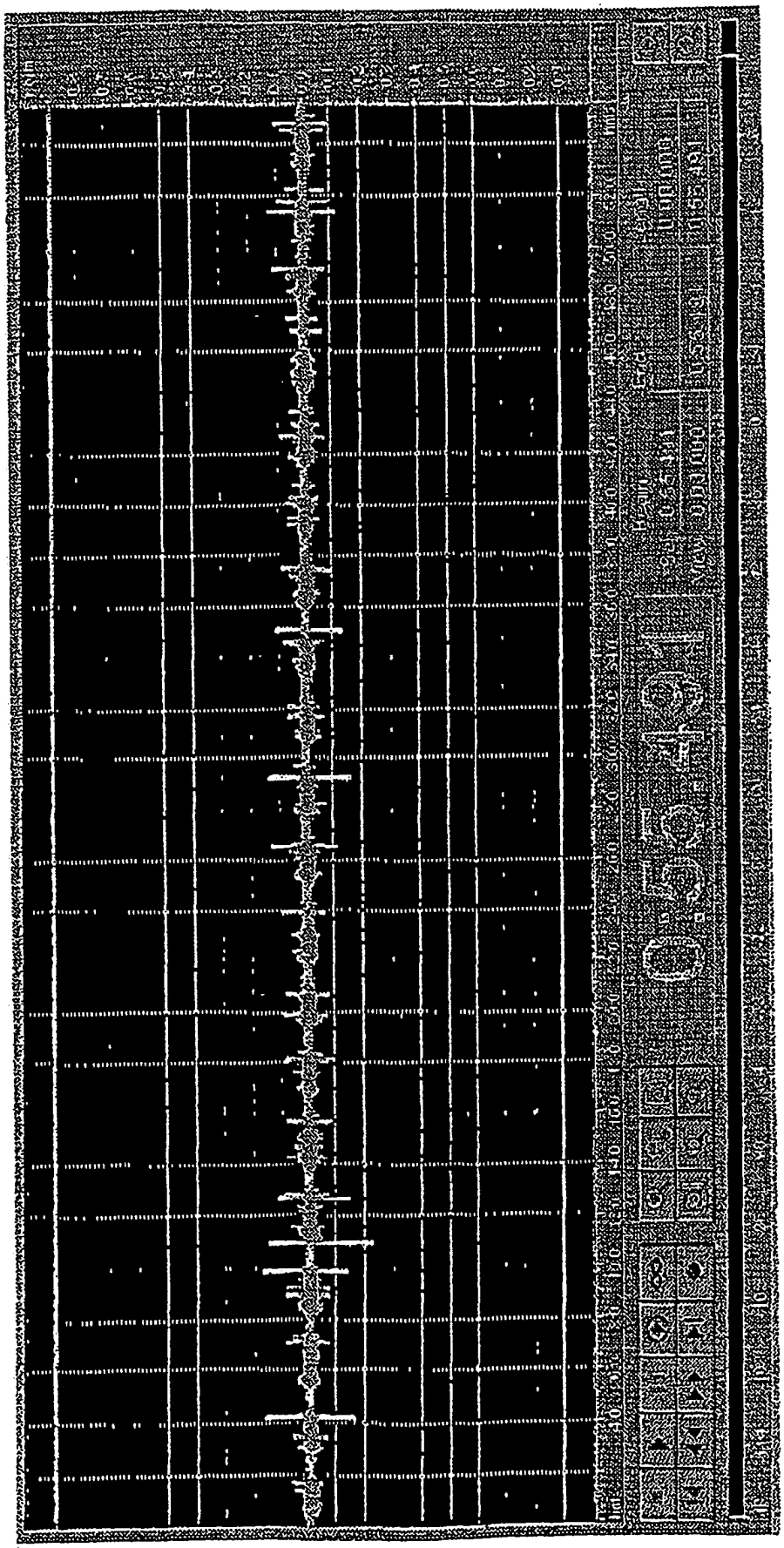

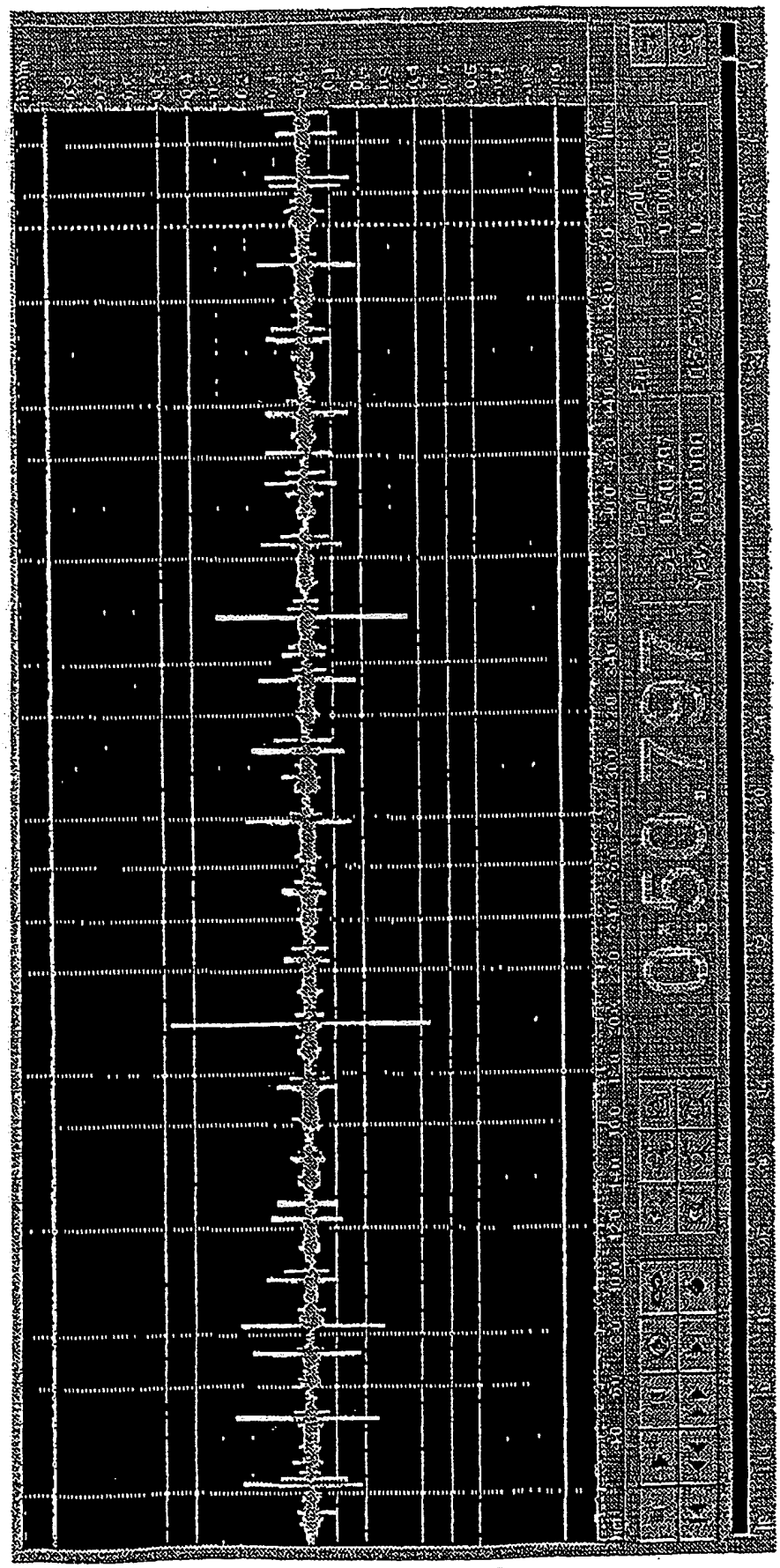

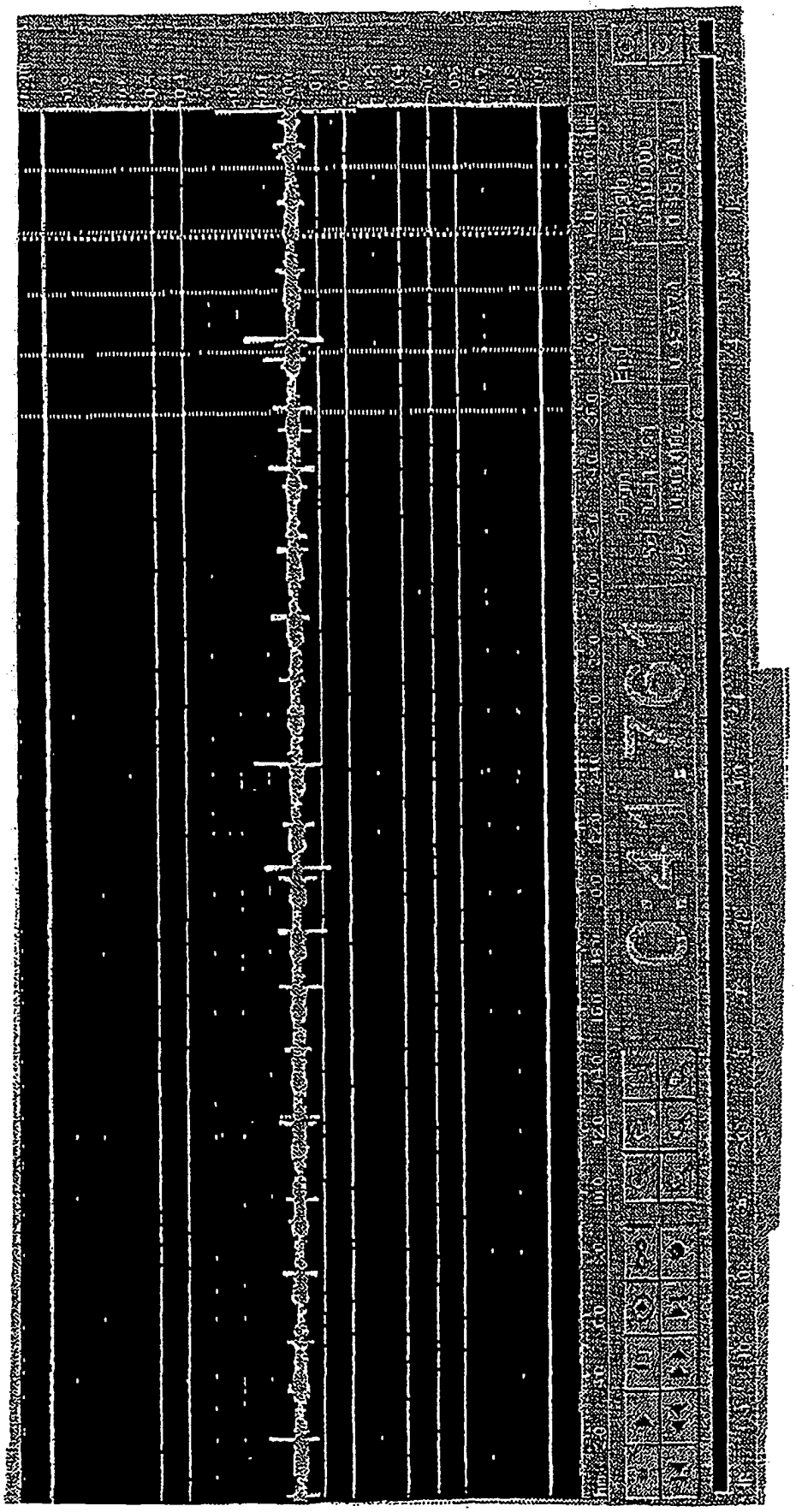

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

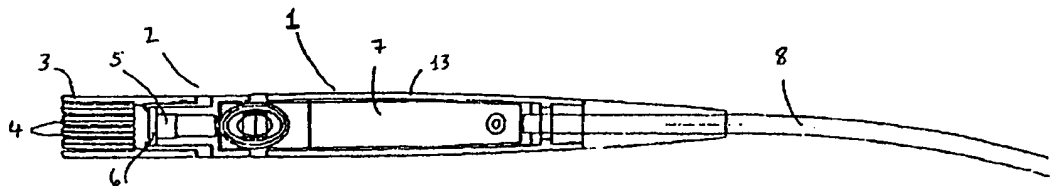
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations*

Published:

— *with international search report*

[Continued on next page]

(54) Title: METHOD, APPARATUS AND SYSTEM FOR ASSESSING HAIR CONDITION



(57) Abstract: Method for measuring friction in a hair sample, comprising: (a) providing a friction member; (b) drawing it through the hair, generating a frictional noise signal; and (c) capturing the signal by a noise sensor. Device suitable for use in said method, comprising comb means having a plurality of tines and a noise sensor arranged to capture frictional noise generated by passage of comb means through the hair. System for assessing the level of damage in a hair sample, comprising: (a) defining hair categories; (b) associating with each category a standard trace representative of the frictional noise signal generated when a standard sample in that category is subjected to said method; (c) assigning the sample to one of the categories; (d) carrying out said method on the sample; (e) visually displaying the frictional noise signal generated as a trace; (f) and comparing the sample's trace with the standard trace associated with the category.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 018 (P-1673), 12 January 1994 (1994-01-12) & JP 05 256631 A (POLA CHEM IND INC), 5 October 1993 (1993-10-05) the whole document ---	1-16
A	DE 27 19 482 A (HENKEL KGAA) 9 November 1978 (1978-11-09) the whole document ---	1-16
A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 429 (P-785), 14 November 1988 (1988-11-14) & JP 63 163143 A (NEC CORP), 6 July 1988 (1988-07-06) abstract --- -/--	1-16

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 February 2002	07/03/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Bernas, Y

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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